mind, more so than the contemplation of the actual results. Looking at the book in this sense, we must consider it of inestimable value to every worker in the same field of research.

The many and great researches of M. Pasteur—amongst which may be mentioned his discoveries that every one of the many kinds of fermentations depends on the growth and activity of a definite and specific microbe; his long-continued controversy and final refutation of the doctrine of spontaneous generation, his immensely practical discoveries on the silkworm diseases, on the attenuation of the virus of splenic fever and of hydrophobia are described with great lucidity and their history and progress rendered in a very spirited and fascinating manner. Reading the volume, one does not know what to admire more in M. Pasteur's life and labours — the way in which a problem is stated, worked, and solved in all its theoretical and practical bearings; the energy and perseverance with which he forces nature to yield up her secrets; the fertility and resources of his genius, or the ready way in which he goes to work to set at rest by direct experiment all objections and to remove possible sources of error. His is a truly grand life and his labours grander still!

The translator is to be congratulated on the admirable way in which she has fulfilled her task. Prof. Tyndall's preface forms an interesting and valuable part of the book. E. KLEIN

The Microtomist's Vade-Mecum. A Handbook of the Methods of Microscopic Anatomy. By Arther Bolles Lee. (London: J. and A. Churchill, 1885.)

IN the preface the author tells us that the aim of the book is to put into the hands of the instructed anatomist "a concise but complete account of all the methods that have been recommended as useful for the purpose of microscopic anatomy," and also "that it is to serve as a guide to the beginner." After a perusal of the book we venture to say that, although the book will prove useful, it is neither a concise, still less a complete, account of all the methods, nor will it serve as a guide to the beginner. As far as we can see, it is a collection of formulæ, published by various authors in various journals and archives, and particularly reported in the *Journal* of the Royal Microscopical Society. The formulæ are more or less promiscuously given, and without an attempt of intelligible selection. For many formulæ references to their authors are given, but in some places these references are incomplete, in others they are wrong, since methods discovered by one are ascribed to another. Nor can we see the use of describing a host of minute and sometimes quite insignificant modifications of a certain method, as A's, B's, C's, &c., method.

As regards the beginner, we venture to say that the book will fail to come up to the expectations of its author. What the author for this purpose ought to have done is to give us a list of ready methods which he himself has tried and found useful in the examination of the various tissues.

The important branch of the examination of living issues, the methods used for the application of reagents, heat, gases, electrical currents, &c., on fresh and living tissues are not included in the book; their treatment, and a few illustrations of apparatus used in microscopic *technique*, would prove a useful addition. E. KLEIN

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*

The Late Prof. Clifford's Kinetic

PROF. TAIT, in his notice of Clifford's "Common Sense of the Exact Sciences" (NATURE, vol. xxxii. p. 124) has brought so prominently forward the statement made in Prof. Pearson's footnote—"the manuscript of the 'Kinetic' was left in a completed state," that I think it is fitting I should somewhat anticipate what will ultimately be stated when the manuscript in my hands has been printed. All the manuscript bearing upon the "Dynamic," after having, I think, passed under Mr. F. Pollock's eyes, was handed over to me, and with it Mrs. Clifford gave me, for use,[1] nine German text-books in case I should need them to fill up any gaps in the manuscript. It is needless to say that there have been "reasons" why this manuscript has not hitherto seen the light; suffice it now to say that the *continuous* portion has been received by Messrs. Macmillan, and the printing is to proceed forthwith. But of what does the *continuous* part consist? I have a draught before me of the work as originally contemplated by the author: Books i., ii., iii., form the "Kinematic"; Book iv., entitled "Forces," is broken up into ten or eleven sections. It is this portion which is *continuous*, and which takes up about forty pages of manuscript. Book v. was to treat of "Stresses;" Book vi., of "Heat;" and Book vii., of "Waves and Vibrations." Of these latter books I have only stray leaves here and there. It is said "Fools rush in where angels fear to tread." I certainly do not propose to try to supplement Clifford's work, but what I do propose is to get out all the *continuous* part in continuation as approximately as I can of the "Kinematic" and to relegate the odds and ends to an appendix. If any mathematician thinks some other course preferable, I shall be glad to let him see the "slips," and will hope to profit by his advice. I am in the receipt of letters from distinguished teachers which express a hope that the lectures I referred to (NATURE, vol. xxvii. p. 4) may see the light; but this point is still, I believe, under consideration. R. TUCKER

University College School, June 13

Sky-Glows

A MAGNIFICENT display of red sky-glow has been seen here. The last observed was in September last (the 17th, the 27th, and the 28th), and only feeble ones have been noticed since up to June 11. At that date the sky glowed with a magnificent grayish pink on the whole of the northern horizon until 9 o'clock p.m. Yesterday the glow was still brighter, and at 9 15 p.m. it extended over the whole of the northern and north-eastern horizon. It was brighter than even last year, but acquired its maximum of brilliancy at a later hour than last summer.

Clairvaux-sur-Aube, France P. K.

Flying Fish

AN excellent opportunity of observing the aerial means of propulsion in the flying fish was afforded me during a six days' calm lately when crossing the Bay of Bengal. This must be my excuse for again touching this subject. I watched day by day some hundreds rise under the bows of the ship. The water surface was a glassy calm. As each fish rose it spread its wings at once, apparently beating the surface with them two or three strokes before they steadied out. I say apparently, for it was not a definite beat so much as a struggle to rise. The tail which, of course, under water was in rapid motion, to escape from the ship, now gave ten or a dozen rapid beats, which could be counted by the ripples on the still surface, and the fish was off in aerial flight. As each fish lost the impetus of the first rise, which generally happened at about forty yards, the binoculars showed us the anal fins, which had till now been fully extended, drooping to feel the water. As soon as the surface was felt the tail was quickly introduced, and five or six smart strokes, also indicated by ripples, brought the impetus up again and carried the fish about another thirty yards, when another droop sent it on again, and so forth, some of the older fish travelling in this way 400 to 500 yards. The younger fish frequently fell awkwardly in this attempt to regain impetus. Where waves are running it requires a clever fish to gain impetus by a few judicious strokes on the crest of a wave, and many a fish tumbles over in the attempt.

I once saw a fish rise close to the ship's quarter, and it flew parallel with the ship, pursued below by a dolphin or bonita. The latter followed every sway of the flying fish, keeping almost under it. At the first dip of the tail the pursuer made a dart forward, but missed it, and again dogged its pray by keeping

[1] These books are to be presented to University College Library after I have done with them.

just under it. On the second dip the tail went into its pursuer's mouth, and there was an end of the flyer. It always struck me that it seemed a strain on the fish to keep the wings extended.

May 15 ALFRED CARPENTER

THE UNIVERSAL MERIDIAN[1]

AFTER some preliminary historical matter Dr. Janssen proceeded:—The question as to which of all the meridians encircling the earth ought to serve as the starting line in the general numeration of the longitudes, is the question known as that of the *prime meridian*—a famous question oftentimes taken in hand, never definitively settled, and which the Congress of Washington was charged to decide. Such was at least its intention.

The ancients, who had just ideas in all matters, perfectly understood that a prime meridian ought to be placed at the origin of the lands to be measured. Marinus of Tyre, and after him Ptolemy, chose quite naturally, as the point of departure for their longitudes, the extremity of the world which was best known to them. What was this extremity? It was the islands which navigators encountered beyond the pillars of Hercules in an enchanting climate, where the inhabitants, freed from every toil, lived in peace and happiness on the abundant spontaneous fruits of a prodigal soil, the Fortunate Isles, as they were called, which people pleased themselves with assigning, as a final resting place (Elysian fields) to the souls of heroes!

Homer, Hesiod, Pindar, Plutarch, speak to us of these Fortunate Isles, which were then regarded as the extreme limit of the western dependencies of Africa. Afterwards they were the unknown solitudes of the ocean.

It is from these isles, then, that the great heir of the geography of the Greeks starts his numeration of longitudes. Here again, however, the ignorance of the ancients in the matter of measures did not allow the maintaining of so natural a point of departure. The indifferent knowledge of the position of the Fortunate Isles damaged the whole system, and people later on were compelled to revert to the continent where the measures were less uncertain.

Following Greek science came the middle ages, when the scientific idea disappeared, and was replaced by a religious or political idea. The first line of longitudes was taken anywhere. People took their meridians from capitals, or remarkable places; every one chose his own centre, and the confusion grew to be intolerable. It is noteworthy how it was France which gave the signal for the resuscitation of the scientific idea in this question, and that it is to the great Richelieu we owe it.

It is, however, a false idea of Richelieu's action to consider it as directed by a pure intention of scientific reform, and by the desire alone of serving the general interests. Richelieu is above all a political spirit, and political interests dominate his preoccupations. At the same time, however, he is a unifying and innovating genius, who feels the necessity of order and serves that necessity by general, great, and elevated measures, for such is the form of his spirit.

What, in fact, was the point of departure of a reform such as science disengaged from all personal interest would alone dictate at the present day? A jealous quarrel among maritime nations in reference to commerce!

At the commencement of the seventeenth century France made a trial of commerce in distant parts, particularly in the Indies and America.

The navigation and traffic of these countries were then in the hands of the Spanish and Portuguese, who, however little they agreed on the division of these rich spoils among each other, were nevertheless wonderfully united when there was a question of interdicting others from sharing in them. The French ships appearing in the seas either of the East or West Indies were, in point of fact, chased by the Spaniards and the Portuguese! Awaiting the time till he had rendered the French navy strong enough to dispute with these nations a property which on the whole was the right of all the world, Richelieu sought to draw around France a maritime zone of protection. He accordingly negotiated and obtained that on this side of the prime meridian fixed on this occasion and to the north of the tropic of Cancer every French ship, whencesoever it may have come and whatever its cargo, should be safe from the pursuit of foreign vessels. Beyond these limits the argument of the strongest was to have force. France was at peace with Spain and Portugal on this side, at war on the other. A curious state of affairs, recalling to some extent the word of Pascal: "Vérité en deçà, erreur au delà!"

And yet have we really the right at this day to look on an arrangement of this kind as such a strange one? Have we not now what the casuists of international law call the *état de représailles*—a state in virtue of which one may blockade the ports of a nation, burn its arsenals and destroy its armies, without being in declared war, and without ceasing diplomatic relations with it?

The object of the great Minister was evidently to secure a refuge for our marine till such time as it was able to contend with others—a goal for which he laboured with such admirable success that before his death our navy was constituted and the basis laid of that colonial greatness which came with Louis XIV. and Colbert.

Such, then, was the political motive at work. But in pursuing this question of colonial commerce the mind of Richelieu was for a moment turned to geography. He needed a pure line of demarcation, not liable to be disputed, and found it in the ancient meridian of the Canaries. He resumes the geographical idea of Marinus of Tyre and of Ptolemy. He places his meridian as far to the west as possible in the archipelago of the Canaries—in the island of Ferro, and the longitudes are to be counted east of it. All the other meridians of the continent are excluded.

Accordingly, and I insist on the fact, all the qualifications of a universal meridian, such as science might be able to establish at this day, were combined in Richelieu's meridian.

(1). It is universal and fit to be so, seeing it personifies no nation, but is, on the contrary, the determination of a purely geographical idea; namely, the position farthest to the west of the ancient world.

(2). The numeration of the longitudes is very natural. It brings the numerical augmentation of the longitude into harmony with that of the local time. It sets forth no negative longitude—a system which, in our opinion, is defective, when there is a question of universal numeration of longitudes.

(3). It places the first meridian in the sea, as geographers have always desired.

The appointment of Richelieu had but one fault: it was in advance of its time—not in respect of its utility and urgency, but of its means of realisation.

In order to establish a meridian at any point it is necessary to be able to connect this point exactly with all well-known points which are to be brought into relation to it. Now, by reason of various circumstances, chief amongst which was the state of war then prevailing, the longitude of this island of Ferro was not known till a century later, when P. Fouillée, astronomer and naturalist, proceeded to the Canaries by order of the King and the Academy, and there made observations on the occultations of the satellites of Jupiter, whence he determined the position of Orotara in Teneriffe, and consequently, by means of a triangulation, the position also of the island of Ferro.

[1] Lecture by Dr. Janssen at the Paris Geographical Society.